

# The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. L  
D. 1301

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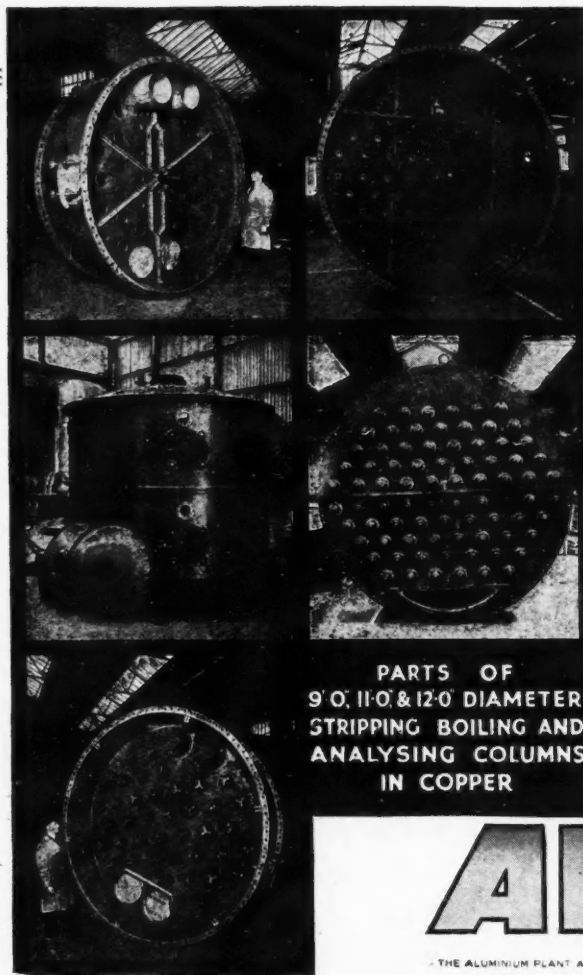
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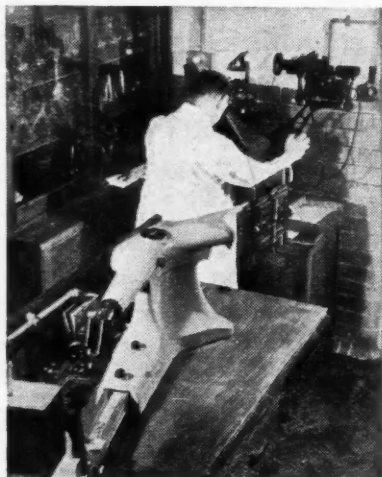
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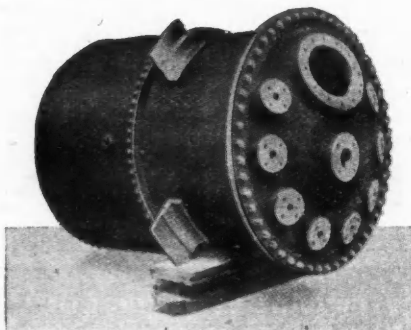
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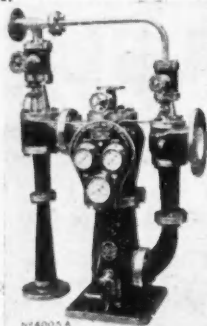


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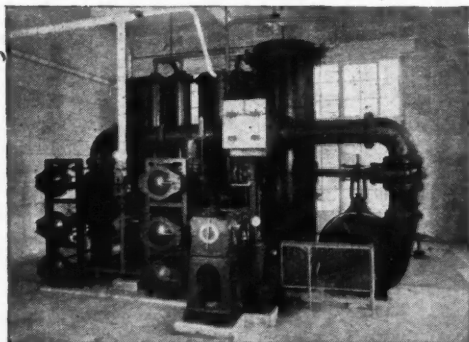
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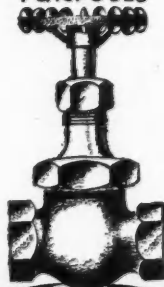
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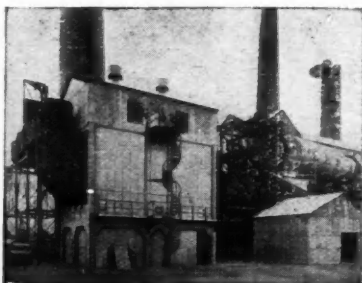
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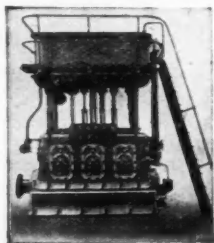
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## Spent Pickling Liquor

THE paper read by Mr. Norman Swindin before a joint meeting of the Institution of Chemical Engineers and the Chemical Engineering Group reveals an interesting situation in regard to the treatment of spent pickling liquor. The paper consisted for the most part in a masterly résumé of the subject by one who had clearly made a detailed study of it over a number of years. Pickling of iron and steel is necessary for a variety of reasons. Into the technique and purposes of pickling we do not propose to go. It will suffice to say that the removal of oxide scale from steel is an essential part of almost all branches of steel production and engineering, and that the preparation of a clean surface for painting is necessary if the paint is to do its work of preserving the metal. Thus a very high proportion

of sheet steel, wire, tubes, bars, and plates is treated for scale removal, either by sand-blasting or pickling. Sometimes these operations are conducted in large works, and at other times in small works. That is one of the difficulties in the disposal of the liquor. Another inherent difficulty has been the outlook of those who operate the pickling process. They are engaged in the working of metals; their interest is in the production of goods,

structures, plant, and so forth, made of metal, and the pickling process is regarded only as a means to that end. It is easy to regard the expenditure of acid for pickling as part of the cost of making the finished steel goods, and to care little what happens to the acid when it has served its purpose. The chemical engineer and the chemist, on the other hand, are distressed to see so much recoverable material going down the drain. Mr. Swindin rightly says: "In the end the making of steel is a metallurgist's job; the disposal of spent liquor is one for the chemical engineer."

Thus the position has arisen that the iron and steel industry has for many years been throwing away a raw material which the chemical engineer can use.

There are many ways in which spent pickling liquors can be utilised in chemical industry. If it is true that "the manufacturer is slowly but surely realising that disposal of waste is a necessary manufacturing cost," it is equally true that most manufacturers will not spend money in disposing of waste unless compelled to do so by force majeure. The "irresistible force" in this instance is usually some local or river authority which insists that the spent liquor shall be neutralised.

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lised before it is discharged into rivers and sewers. This force, however, is not as yet sufficiently potent to make manufacturers go the whole way towards putting the contents of spent liquor to some useful purpose.

The most hopeful line of attack is for chemical manufacturers generally to be made aware of the extent and location of the supplies available, in order that they may consider whether the liquor can be worked into their processes. Presumably it would not pay to transport it over any distance greater than perhaps 20 miles; we do not know, and the answer must depend on the use to which the liquor is to be put, since that will govern the cost that may be incurred in getting it there. Dozens of methods were described by Mr. Swindin, but among them one or two may be picked out to illustrate the sort of things that might be done. The gas industry and the coke-oven industry have a problem in the liquid purification of coal gas. It should not be beyond the capacity of chemists to work out a process whereby the crude liquor can be used to absorb ammonia and hydrogen sulphide from the gas with ultimate precipitation of ferrous sulphide. If this process is to be used, there must be some guarantee of regular supplies of spent pickling liquor. Therein lies a difficulty, since it would be costly to store the liquor for long, and many iron and steel works do not pickle regularly, but periodically. Can the carbonising industry rely on supplies? The answer appears to lie in statistics; and this is peculiarly a problem in which the requisite statistics can only be obtained by local enquiry.

Various methods have been suggested whereby the iron may be converted into pigments; the free acid is neutralised by scrap iron, the liquor is filtered, then treated with lime to form ferrous carbonate. This is then filtered off, washed and heated in a furnace to obtain the desired shade and fineness. A modification of this process, in use at the works of Pilkington Bros., Ltd., evaporates the solution in a spray drier to produce  $\text{FeSO}_4 \cdot \text{H}_2\text{O}$ , which is roasted in a gas-fired muffle to produce a fine oxide for glass polishing. This type of process can be operated intermittently, and is thus less dependent upon constant flow of supplies.

Mr. Swindin has summarised the known

processes for treatment with recovery of usable products under ten heads according to what is produced, namely, (i)  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  or  $\text{FeSO}_4 \cdot 5\text{H}_2\text{O}$ , (ii)  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  and free  $\text{H}_2\text{SO}_4$ , (iii)  $\text{FeSO}_4 \cdot \text{H}_2\text{O}$  and free  $\text{H}_2\text{SO}_4$ , (iv) ferric sulphate and free acid, (v) iron oxide and sulphuric acid, (vi) electrolytic iron and sulphuric acid, (vii) paint pigments, (viii) ferric hydroxide,  $\text{FeS}$ , and similar products, (ix) Ferron, and (x) miscellaneous products, such as prussian blue. With so wide a choice it would appear strange if the chemical industry could not find a use for the whole of the spent pickling liquor in the country, provided that the cost of transport did not defeat the effort. Even that might be met by carrying out the earlier part of the process locally, either in the works in which the liquor is produced, or at a neighbouring chemical works which could then despatch the intermediate product to another more distant works to be treated. It is all a matter of economics, which in turn involves market prices and local conditions. There must be an enormous wastage of iron through pickling, though this is, of course, much less than would be wasted by weathering after painting if the iron had not been pickled. The loss in pickling seems to be about  $\frac{1}{4}$  oz. per sq. ft. of surface. It is likely, moreover, that the practice will increase. The Corrosion Committee of the Iron and Steel Institute and the British Iron and Steel Federation has reported strongly in favour of pickling or sand-blasting, and at least, if no other use can be found for it the recovered material can be put back into the blast furnace.

Mr. Swindin's conclusion is that, for some time to come, the usual pickle recovery plant will produce  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ , "which will be a drug on the market, and in order not to disturb too much the adventitious processes, copperas will have to be converted to iron and acid . . . . What now remains is to work out an organisation for collecting copperas and in time monohydrate sulphate, and establishing some central depot fully equipped with an up-to-date roasting plant and sulphuric acid contact plant for conversion. The recovered acid will be returned to the various works and the oxide reduced to iron in a blast furnace." This suggestion deserves to be carefully considered.

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## NOTES AND COMMENTS

### Floodlight on Patents

IT has for some time been evident that there is a general feeling of dissatisfaction abroad concerning the system by which patents are granted in this country. It was not just accidentally that two of the great British chemical concerns published surveys of the situation earlier this year; and the demand for patent reform has now found articulate expression in two letters written to the Editor of *The Times*. In the first of these, Dr. Eccles calls attention to the fact that the annual number of British patents granted to German nationals increased by some 48 per cent. during the 30 years before this war, and somewhat disconsolately regards this as a measure of our backwardness in technology. Dr. Levinstein, however, in a later letter, does not agree as to the cause, while equally deploring the effect. It is well known (e.g., in the preparation of synthetic anti-malarials) that the Germans have a habit of patenting every possible way of producing an article the manufacture of which they wish to keep to themselves, and, as Dr. Levinstein points out, our Patent Office (unlike the German and others) may not satisfy itself, before granting a patent application, that the claims contain proper subject-matter. This in itself plays into the hands of those who wish to patent bogus processes which are never likely to be put into practice but exist merely to discourage inconvenient competition. Patent litigation is expensive, and most patents remain in force if the renewal fees are paid; and the extent to which trade is restricted by the grant of worthless patents is too little appreciated.

### Nine-Tenths Waste

STATISTICS, quoted by Dr. Levinstein, concerning the number of patents that are apparently of little value to the patentees, reveal that there is something wrong somewhere. Of the patents sealed in the period 1919-32, over half were not renewed after the initial four-year period, thus showing that they were not worth the renewal fee of £5 in the eyes of their owners; and only 3.7 per cent. were kept alive for the full 16 years by the payment of the fee

of £126. These figures agree remarkably with the results of actual patent litigation. Of the patents tested in the High Court, 90 per cent. fail from lack of subject-matter; and from the figures quoted above it looks as though over 95 per cent. might well have been strangled at birth. The trouble is that the patent authorities have their hands tied, and are therefore not in a position to do the strangling. One further point of Dr. Levinstein's is of interest. The course of this war has shown that we are second to none in inventiveness; but it is unfortunately true that we have been less attentive than either the Germans or the Americans in the application of our ingenuity to industry. Consequently, and taking also into consideration their larger populations, it is not to be wondered at that a quicker flow of inventions has emanated from those nations. This makes an even stronger case (if one were required) for evolving some system whereby it might be possible to avoid doling out vast numbers of monopolies to foreigners indiscriminately. Self-preservation reinforces common sense in the demand for a rapid revision of the Patent Law.

### Technical Efficiency

THIS is not the place for a full-length review of the Government's White Paper on Employment Policy, the perusal of which may have filled in the leisure moments of some of our readers over the Whitsun week-end. There are one or two points in it, however, which we should like to place on record as being of special interest to the chemical industries. One difficulty that the Government is anticipating is the possibility of a decline in the volume of imports received in exchange for a given quantity of our exports. This would be more than offset by continued progress in technical efficiency, the dominating factor in the growth of real national income. Our burden will be vastly lightened if British industry carries into the peace the inventive power, technical skill, and adaptability which it has shown during the war. Chemists and chemical engineers are not likely to slacken off their efforts towards technical progress when they know that the

well-being of the country depends on them; and the corrosive poison of unemployment is quite as deadly as the fire and sword of a physical adversary. The Government states also its intention of encouraging new industries in "development areas"—a euphemism for "depressed areas"; it will be interesting to see how this dovetails with the proposed regulation of private capital expenditure on "buildings, machinery, and other durable equipment."

### Methane Buses

**D**URING this war a number of people have advocated that we should make better use of such supplies of methane gas as are available in Britain. At present most of it is allowed to escape into the air and is simply not used at all. On the other hand, it must be admitted that it is not the most con-

venient source of fuel to handle. The latest number of the *Anglo-Swedish Review* contains an interesting note about methane and its exploitation in Sweden, where coal and petrol are scarce, and the search for alternative fuels has been intense. Stockholm's new sewage disposal plant, which was put into operation a few years ago, produced over 1,000,000 cubic metres of methane gas during 1943. This year production will be increased by 30 per cent. through further extensions of the plant. The methane gas is used by the buses and motor cars belonging to the city authorities, and has proved to be a most welcome fuel. The production cost of one cubic metre is 25 öre (3½d.)—about the same as the pre-war price for one litre of petrol in Sweden. One cubic metre of methane is almost equivalent to one of litre of petrol when used as motor fuel.

## Society of Chemical Industry

### Annual Meeting Dates

**T**HE sixty-third annual meeting of the Society of Chemical Industry will be held on July 13 and 14. On the former day the meeting will be at Stewart's Restaurant, 50 Old Bond Street, London, W.1. The Council will assemble at 2.30, and after tea there will be a meeting of chairmen and hon. secretaries of Sections and Groups. At 7.30 the London Section will meet jointly with the Institute of Metals in the premises of the Institution of Mechanical Engineers, Storey's Gate, S.W.1.

The annual meeting proper will open on the morning of July 14 at 10.30 at the Royal Institution. The election of officers and the usual business items will be followed, at 11.30, by the president's address. The afternoon session starts with the conferment of Honorary Membership on Dr. Cullen (at 2.45), followed by the presentation of the Messel Medal to Professor A. V. Hill, sec. R.S., M.P. After that ceremony Professor Hill will deliver his address as metallist. The proceedings will close with tea in the library, by invitation of Dr. and Mrs. Cullen. Members are reminded that if they wish to arrange for lunch on July 14 they should make early application, as the available space will have to be balloted for.

There are four vacancies for ordinary members of Council, and six candidates have presented themselves for election: Dr. C. G. Addingley, Mr. J. P. Baxter, Mr. J. W. Cragge, Dr. J. Vargas Eyre, Mr. J. S. Jackson, and Mr. J. A. Oriel. Every member should have received a ballot paper to fill in and return to the hon. secretary by July 13.

## Institute of Physics

### Annual Report

**T**HE report of the Institute of Physics records plans which are now being made so that this young profession can continue its vital service for the development of our industries when hostilities cease. In particular, the Board of the Institute has given consideration to the position of physicists and those desiring to enter the profession during the demobilisation period. Through the Joint Council of Professional Scientists, it is co-operating with qualified scientists practising in other branches of science such as chemistry, biology, and geology. Active steps have been taken to follow up the recommendations contained in the Institute's Report on the Education and Training of Physicists. The inquiry into "the possibility of including the various branches of technical physics within the framework of National Certificates and Diplomas" has made good progress.

At the annual meeting on May 22 the following were elected to take office on October 1. **President**, SIR FRANK SMITH; **vice-presidents**, PROFESSOR J. D. COCKCROFT, Mr. T. SMITH and Dr. F. C. TOY; **hon. treasurer**, MAJOR C. E. S. PHILLIPS; **hon. secretary**, PROFESSOR J. A. CROWTHER; **members of the board**, Dr. H. LOWERY, PROFESSOR N. F. MOTT, PROFESSOR E. A. OWEN, Dr. SYKES, Mr. R. S. WHIPPLE, Mr. C. S. WRIGHT.

**MAJ. GEN. SIR EVAN GIBB** has been re-elected president of the London Chamber of Commerce.



## Solvent Extraction—III

### Liquid Extraction of Fine Chemicals

by G. COLMAN GREEN, B.Sc., F.R.I.C., A.M.I.Chem.E.

(Continued from THE CHEMICAL AGE, May 27, 1944, p. 501)

**E**XTRACTION from liquids is usually employed in the drug and fine chemical industry in intermediate separation and purification operations and in the stripping of weak liquors such as effluents where other methods may be inapplicable on grounds of cost or practicability. There are no major processes within the industry in which liquid/liquid extraction is applied direct to an incoming raw material. Minor applications occur, such as the extraction of hormones or carcinogens from such fluids as urine, and specially designed extraction plant for operation of this nature exists in various hospitals and elsewhere in this country.

#### Oil Refining Practice

The application of solvent extraction to oil refining is such a pivotal one in the development of liquid/liquid solvent extraction as a unit chemical engineering operation that it is impossible to avoid reference to it. The most recent summary is that of Ter Meulen<sup>25</sup>, while more detailed description of principles, application, and methods is given by Hunter<sup>26</sup>. With regard to solvent extraction of oil the position is, briefly, that, prior to about 1930, the production of lubricating oil was based on distillation methods and the yield of oil, wax, asphalt, etc., varied according to the type of oil extracted from any particular well. During the past decade solvent extraction methods have been elaborated so that oil of a definite specification can be obtained from any crude, independently of its original character. This has been achieved by the suitable selection of solvents and solvent mixtures and reaches, perhaps, the culminating point, technically, in the Duo-Sol process, where cresylic-acid/phenol mixtures remove the naphthenic constituents and propane precipitates the asphaltic constituents into the raffinate. The phenol/cresylic-acid component acts as a mixed solvent; but this mixture is immiscible with the propane. The price of lubricating oils is relatively low and this carries the important implication that a

great volume of crudes has to be treated at a relatively low cost—one of the main features of the application. The three major principles on which plant design has turned are the selectivity of the solvent, efficient contacting of the phases, and efficient recovery of the solvent. It should be stressed that these principles are fundamental to all solvent extraction operations.

#### Acetic Acid Recovery

Returning to what one may regard strictly as the chemical industry, the largest application is perhaps the recovery of acetic acid liquors which accumulate in the production of cellulose acetate. In the last war straight distillation plants were established in this country for the recovery, but proved unsatisfactory. They were subsequently replaced by plants using azeotropic distillation methods with, for example, isopropyl acetate as entrainer. Suida, however, developed a solvent extraction process using crude tar cresol or wood tar oil as solvents, and Les Distilleries des Deux-Sèvres modified the process by using petroleum as an adjunct to obtain more efficient separations. It is claimed<sup>27</sup> that acetic acid liquors may be strengthened up from 30 per cent. to 99.8 per cent. glacial, with a yield of 98 per cent. and at a cost of 1d. per lb. of glacial acetic acid obtained which is an outstanding achievement.

Butyl alcohol has been described<sup>28</sup> as a selective solvent for extracting 2 : 3-butylene glycol from corn mash fermented by *Aerobacter aerogenes*. 2 : 3-Butylene glycol is used as a raw material for butadiene synthesis and it is believed that a plant using this solvent extraction method was established in Holland before the present war. It seems probable that the process may now be in operation in America<sup>29</sup>. Another extensive application of liquid/liquid extraction is in the washing out of benzol from tar-oils, the plant for which has been developed empirically over many decades.

Liquid/liquid solvent extraction is as

frequent in the fine chemical industry as an intermediate operation as it is in the organic chemistry laboratory, where it serves the similar purpose of separation and purification. Indeed, the former may be regarded as a projection of the latter. The transference to a larger scale does not alter the principles involved; but limitations are set by what is practicable. For example, one seeks to use solvents which are immiscible or only slightly miscible and cases are rare in the fine chemical industry where solvents which are largely miscible are used. The underlying theory of miscible solvents has not been so thoroughly worked out, but this aspect has been given attention recently by Hunter<sup>30</sup>.

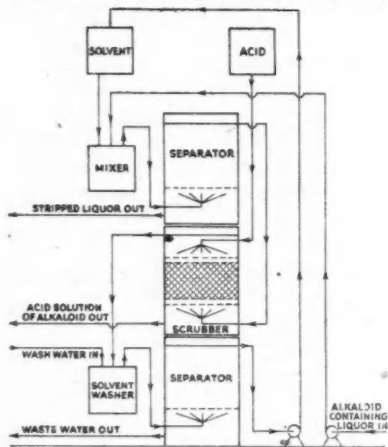
Purification of the alkaloids is an important and interesting application of liquid/liquid extraction. This group of compounds is characterised by the release of the base from its salt in alkaline solution. As the salts of the bases are soluble in water and the bases are themselves, generally speaking, soluble in non-polar solvents, they may be separated by means of this unit operation with advantage. The bases themselves may then be recovered from the organic solvent by a reverse process of extracting

is achieved<sup>31</sup>. By careful adjustment of conditions it is claimed that a number of alkaloids in a complex mixture may be successively separated by the method<sup>32</sup>.

The operations may be carried out, according to circumstances, on the batch system or by a continuous counterflow method, efficient contacting and rapid separation of the phases being the guiding features. For a small-scale batch extraction, and especially where emulsification is likely, a cylindrical vessel with a central stirring shaft, hand or mechanically turned, carrying two propeller-stirrers set so that one operates in each phase, is common. At the other end of the scale the two phases may be deliberately emulsified and separation subsequently obtained by centrifugal means, a method which is clearly expensive in power. Counterflow batch methods are, naturally, common, and Fig. 5 shows an ingenious adaptation to the extraction of an opium alkaloid by Pfeisterer of Stuttgart.

The solute may be separated from the extracting solvent by distillation; but in many cases, as has been indicated, the solute is removed from the water-immiscible organic solvent by extraction with aqueous acid. This method is especially useful where the solute is heat-sensitive, as are many of the active principles of natural origin; and, again, the method has a clear economic advantage where the salt of the base has a low solubility in aqueous acid and can be easily precipitated out in the aqueous phase. This "reverse" extraction may, of course, be accomplished by counterflow methods either in stages or continuously. Although distribution may be in favour of the non-aqueous phase, conditions of pH, temperature, etc., may be so chosen, in some cases, as to cancel what would otherwise be a disadvantage in this reverse extraction from the oil back into aqueous phase.

Where a chemical reaction is involved in addition to liquid/liquid solvent extraction, the rate of the chemical reaction may be controlling and not the rate of diffusion through the liquid film as is usually the case. Where a reversible action is involved, if the equilibrium constant is known the partition coefficient can be calculated or *vice versa*<sup>33, 34</sup>. This device is important not only in physical chemical research, but also in applications



**Fig. 5. Continuous alkaloid extractor.** into aqueous acid solution. Strychnine, codeine, apomorphine, emetine, hyoscyamine, quinine, eserine, and ergotoxine are extracted in this way, and a large measure of concentration and purification



in the fine chemical industry where liquid/liquid extraction is often being undertaken of a weak base which is in combination with a strong, or moderately

may lie between 0.02 in. and 0.04 in. Where the solubility in one phase is high the film in the other phase is controlling and conversely. Little, however, is

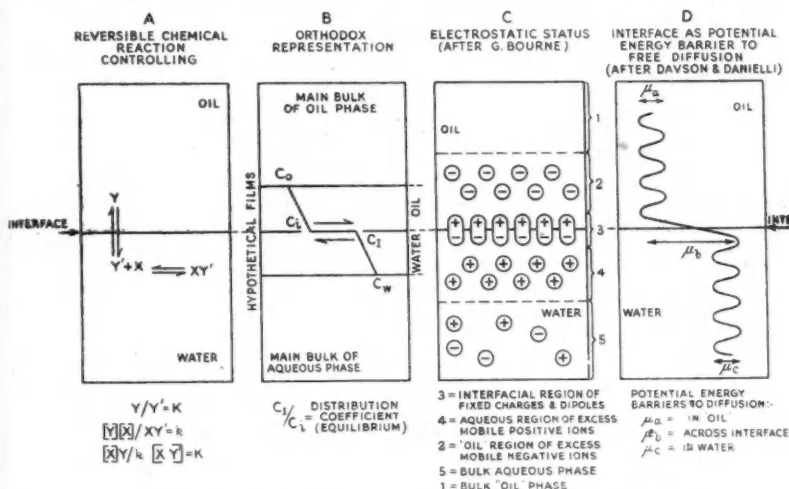


Fig. 6. Interface status: diagrammatic representation.

strong, acid in the aqueous phase, when a measure of hydrolysis may occur. By careful adjustment of pH, for example, it is often possible to obtain a sharp separation of the base from impurities. The situation is shown diagrammatically in Fig. 6 (A).

The conventional method of representing the situation at the interface is shown in Fig. 6 (B). The two phases are regarded as being in equilibrium at the immediate interface. If by convection or agitation the main bulks of the two phases are prevented from developing concentration gradients, then the resistance to transfer of solute from one phase to another is due to resistances within two liquid films considered to exist on either side of, and adjacent to, the interface. The driving force for material transfer is, of course, the concentration gradients across these two films which are in viscous flow, and either film may be controlling. The films are not to be regarded as molecular films, as they correspond more nearly with those set up at interfaces in fluid flow. As an example of the *effective* thickness of these films that of water

known of these film resistances and only a few individual values are available.

David and Crandall<sup>35</sup> have made the interesting observation that, where a chemical reaction takes place in one or other of the phases, the site of the reaction is in the film. This may considerably complicate the extraction aspect. It has been reported<sup>33</sup> that 60 per cent. sulphuric acid absorbs isobutene faster when the acid is quiescent than when it is stirred. This is due to the fact that, when the acid is quiescent, butyl alcohol accumulates at the interfacial film until the rate of diffusion in the main bulk of the acid phase is equal to the rate of formation. This alcohol increases the solubility of the isobutene and hence the absorption coefficient is increased.

The notion of the existence of a film at either side of the interface is purely conceptual but it provides an essential working basis for the calculation of parameters. The concept of "film resistance" is an expression in a concise form of the many and complex effects which may be occurring in a thin stratum of liquid adjacent to the interface. The problem

of the transfer of material across an interface has an important bearing in biophysics and what may be learnt here by the chemical engineer is not to be ignored. There is the danger here that the idea of a "film" and of an "effective film-resistance" may become too rigidly mechanistic, and therefore that certain characteristics of the transfer across the interface, which have wider implications in liquid/liquid extraction, may be missed.

#### Classification of Solutes

As Davson and Danielli<sup>26</sup> have pointed out, the resistance effects arise from surface phenomena which impede free diffusion throughout the system and produce a potential energy barrier to diffusion at the interface. On arrival at the interface, diffusing molecules of the solute become orientated so that, on the average, the positive ends of the electrostatic dipoles are directed towards the non-aqueous layer and the negative ends towards the aqueous layer. The molecule is now in a position such that for every polar group it possesses there exists at least one hydrogen bond with water, and all these bonds have to be broken *simultaneously* and enough kinetic energy has to be available for the molecule to knock a sufficiently large hole in the non-aqueous layer and thus pass into it. Glycerol, for example, with three hydroxyl groups, would require such a large amount of energy that only rarely will a molecule diffuse into the non-aqueous layer. A predominantly hydrocarbon grouping such as that of carotene, which is made up of many non-polar  $-CH_2-$  groups, has no hydrogen bonds with water and little or no energy is required for the transfer to the non-aqueous phase, so that it readily passes over. By contrast with these two examples, methyl alcohol, which has one polar and one non-polar group, is enabled to distribute itself between both phases. Implicit in this is the fact that the partition coefficient of a solute, so fundamental in solvent extraction calculations, depends upon the balance of the polar and non-polar groups which it possesses, and both ultimate equilibrium and rate of transfer are affected. Danielli<sup>27</sup> classifies solutes into four divisions as follows:—

(a) Molecules having few polar and few non-polar groups; *e.g.*, oxygen, methyl alcohol. In this case resistance

to free diffusion throughout the two phases is negligible.

(b) Molecules having many polar and many non-polar groups; *e.g.*, poly-hydroxylic bile acids, the glucuronide of oestrin, proteins. In this case resistance to diffusion from either phase into the other is limiting and rate of transfer is very slow.

(c) Molecules which are predominantly polar; *e.g.*, glycerol, sucrose, glycogen. The resistance to diffusion from the aqueous phase is great in the extreme.

(d) Molecules which are predominantly non-polar; *e.g.*, fats, cholesterol, vitamin A, carotene. These substances may be regarded as hydrophobic and transfer to the non-aqueous phase is rapid.

The position is reversed when diffusion from non-aqueous to aqueous phase is considered. For example, when glycerol in an oil phase is brought into contact with water, the molecules of glycerol on arrival at the interface immediately form hydrogen bonds with water, become, in effect, an integral part of it, and diffuse away into the bulk of the aqueous phase. Benzene, on the other hand, forms no hydrogen bonds and cannot become incorporated with the water. The only way in which a benzene molecule can pass into the aqueous layer is by acquiring sufficient kinetic energy for it to become projected into the water, and the frequency of such an acquisition is low. Danielli calculates that 1000 cal. per  $-CH_2-$  group are required as a minimum to transfer a molecule from an oil phase to an aqueous phase. Thus, at least 8000 cal. would be required to transfer a molecule of stearic acid, and 60,000 cal. for a molecule of stearin. The latter is practically impossible.

#### "Controlling" Films

Hence, according to the balance of polarity of a molecule of a solute, it will find a potential energy barrier to free diffusion at the interface and, according as the molecule may be described (as a net effect) as hydrophobic or hydrophilic, the resistance will be found exerting itself at the interface, and, according to these circumstances, in the one phase or the other. Hence, the conception that, in chemical engineering terminology, either film may be controlling. A comparison of the conventional chemical engineering representation and the surface

physics representation of the status of the interface is made diagrammatically in Figs. 6 (C) and (D).

If, in addition to the solute, the distribution of which between the phases is desired, there are present electrolytes in the aqueous phase, a complication arises; and this is a situation which is likely to be present more often than not in drug extraction. The consequence of the accumulation of fixed charges and dipoles at the interface as shown in Fig. 6 (C) is that, for electrostatic reasons, in regions at either side of the interface there exist excesses of mobile ions. This region of excess ions has been calculated to be 0.98  $m\mu$  for 0.1 molar and 31  $m\mu$  for 0.0001 molar and the actual concentration of the ions may be calculated from the Gibbs-Donnan equilibrium. The important thing is that the interplay of electrostatic charges may considerably modify the characteristics of the interface as compared with the situation when the electrolyte is absent. Both the rate of penetration (and therefore the rate of transfer) and the adhesion of the solvents at the interface (and therefore the separation of the phases after contacting) may be affected. It is clear that there is much ground common to the problems of the surface-physicist and the chemical engineer interested in solvent extraction and the work of both the surface-physicists and biophysicists on diffusional problems must be taken fully into cognisance.

#### Rates of Diffusion]

The data available on rates of diffusion across liquid/liquid interfaces are hopelessly lacking; the position is most deficient with gaseous diffusion but it is far worse where solutions are concerned, the kinetics of solutions being far less well understood. Even in the simple cases and the classic cases workers have concentrated upon establishing conditions of final equilibria with little or no consideration as to the kinetics by which these equilibria are attained. Expressions have been established by *a priori* reasoning and by projection from data obtained on gas absorption; but there has been no experimental verification. In the matter of data available in the literature, Elgin's recent summary<sup>38</sup> is worth while referring to.

Continuous counterflow systems for

liquid/liquid solvent extraction have no very extensive use in the fine chemical industry. A recent application described in the literature refers, however, to the extraction of the bacteriostatic mould metabolite, penicillin, which was extracted from the mould fermentation liquors by amyl acetate in a pilot plant established in the pathological department at Oxford University<sup>39</sup>. No details were given as to the design or performance and, indeed, there are reasons to believe the method has been abandoned in larger scale working in favour of one involving more rapid contacting and separation, in view of the extreme lability of penicillin at the pH at which extraction must be effected.

#### Counterflow Columns

Much light has been thrown on the design of continuous counterflow columns by the schools interested in petroleum engineering and especially by Hunter and Nash at the University of Birmingham, and by Colborne, Sherwood, Varteressian and others in the United States. A considerable amount of fundamental data is necessary for satisfactory calculations of columns, and this is often not available in the fine chemical industry. Moreover, a reasonably constant load and constant composition of feed and recirculated solvent are necessary for steady conditions within the column, and these requirements are all too often incapable of satisfaction. Consequently, a preference more often than not arises for the more flexible batch counterflow systems despite their relative lack of economy compared with a column. Nevertheless, allowing considerable margins for these fluctuations, columns can be set up on partly empirical bases and operated with advantage; because of their continuous flow they require more constant supervision. Such compromises are, of course, possible only where operation costs of the particular section are small compared with the total manufacturing costs. In the petroleum industry practice is swinging to a considerable extent in favour of batch mixing and separating instead of continuous counterflow columns, mainly because the tower packing tends to become choked by precipitated material<sup>25</sup>.

Where effluents or intermediate liquors containing impurities of animal or veget-

able origin are being handled, one has to be prepared for the choking of the column packing by materials of high molecular weight. These are often deposited by a change of electrostatic charge or by being "salfed out" through the partial miscibility of the solvents. This may make an otherwise satisfactory column well nigh unusable. In such circumstances one of the alternatives to which one might have to resort is a column or vessel containing the solution through which the solvent is circulated and which resembles the drug extractor described earlier. Such a plant was devised by Morgan and Pettet<sup>46</sup> and used in the investigations of low-temperature tar. Any precipitate, or tarry matter—always provided that it does not collect at the interface, as all too often happens—sludges to the conical bottom of the column, whence it may be withdrawn. This type of apparatus is particularly useful where no risk of loss of valuable substances may be taken.

In the case of packed towers or columns it is important to see that the phase

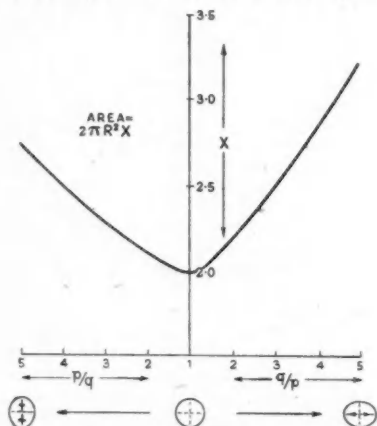


Fig. 7. Variation in area of an ellipsoid, with ratio of axes.

which preferentially wets the packing is the continuous phase, otherwise the dispersed phase will pass through the column in blobs, with consequent inefficient performance.

A final point of interest is that the function of packing in columns is to increase the effective length of the column on account of the zig-zag path which the

drops of the disperse phase must follow. The effect of the flattening of the drop as it passes over the packing surfaces has been overlooked. Each drop, on coming into contact with a packing surface, is flattened from an approximately spheroidal to an approximately ellipsoidal body. The reaction between area and volume as a spheroid becomes symmetrically flattened has been calculated.\*

One has to consider a sphere with axes  $p$ ,  $q$ , and  $r$  at right angles to each other, in which two axes remain of equal length during symmetrical compression along the third axis. It is necessary to obtain the variation in area of the spheroid, as this compression takes place at constant volume. For the purpose of the use of calculus two cases must be distinguished, in one of which  $q > p$  and, in the other  $q < p$ . It may be shown that the area of the spheroid, when  $q > p$ ,

$$= A = 2\pi q \left[ q + \frac{p \cdot \sinh^{-1} \sqrt{(q/p)^2 - 1}}{\sqrt{(q/p)^2 - 1}} \right]$$

and for values when  $q < p$  the area of the spheroid

$$= A = 2\pi q \left[ q + \frac{p \cdot \sinh^{-1} \sqrt{1 - (q/p)^2}}{\sqrt{1 - (q/p)^2}} \right]$$

From these expressions the change of ratio of major and minor axes may be plotted against surface area as in Fig. 7. From this it will be seen that, for example, the flattening of a sphere (in which  $p = q = r$ ), until the two major axes of the resulting ellipsoid are five times the length of the minor axis, results in a 60 per cent. increase in the surface area at constant volume.

Since the rate of diffusion is proportional to the interfacial area, this flattening of drops must profoundly affect the rate of transfer. This may be claimed despite the fact that the above treatment is an idealisation of the problem and despite other limiting factors such as that to which Elgin<sup>48</sup> has drawn attention, namely, that where one phase is in the form of drops it is probable that diffusion within the drop may be a limiting factor.

This aspect suggests that among the other well-known criteria by which a suitable solvent is selected should be

\* In consultation with Mrs. and Dr. K. E. Grew of the Heriot-Watt College, Edinburgh.

included the ability of the liquid to "spread." This property again is a function of polarity of the molecules of the two solvents. Incompletely miscible solvents, each containing groups or radicals of approximately the same polarity, tend to spread on each other; but if they are completely dissimilar in polar character, spreading does not occur. When the similarity of polar characters is sufficiently great, solution will immediately follow spreading, and this must naturally be avoided. In selecting immiscible solvents according to this criterion, a useful, although restricted, list<sup>41</sup> gives benzene, hexane, and chlorobenzene as typical solvents which spread on water; and typical non-spreading liquids on water are methylene iodide, carbon disulphide, medicinal paraffin, and acetylene tetrabromide.

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## IMPERIAL INSTITUTE REPORT

Investigations into the possibility of producing rubber from the coagulated latex of *Euphorbia tirucalli*, in Natal, have led to the conclusion that the cost of production would be too high for the rubber to be utilised, even under the present conditions of shortage. The *Imperial Institute Bulletin* (1944, 42, 1, p. 1) reports, however, that further experiments have been carried out with the resin of the same tree (which would have been a by-product of rubber recovery) with a view to using it in paint and varnish. It was found that euphorbia-resin/linseed-oil varnishes were too slow drying at ordinary temperatures for general use, but that this defect could be remedied by stoving. Limited uses might be found for the resin in the linoleum, oilskin, and leather cloth industries.

A comprehensive article on Pyrethrum Cultivation in Kenya, by Mr. R. S. Ball, agricultural officer in that colony, is also included in the *Bulletin*, while the chief article in the Mineral Resources section deals with the discovery of a deposit of ilmenorutile in Sierra Leone.

## A.C.S. AWARDS

The following awards were made at the recent meeting in Cleveland of the American Chemical Society: Borden Award for Milk Chemistry, DR. WILLIAM MANSFIELD CLARK; Lilly Award in Biological Chemistry, DR. JOSEPH STEWART FRUTON. Dr. Clark, who is De Lamar professor of physiological chemistry at John Hopkins University, is the chairman of the Division of Chemistry and Chemical Technology of the National Research Council. Dr. Fruton is distinguished for his fundamental studies on the isolation, purification, mode of action and specificity of proteolytic enzymes. Another A.C.S. award is that of the Schoellkopf Medal for 1944 to MR. GLEN DAVID BAGLEY, of the Union Carbide and Carbon Research Laboratories, who has done much important work in metallurgy; for instance, he brought the dolomite-ferrosilicon reaction for making magnesium to the pitch of commercial application. Another metallurgist, MR. JUNIUS D. EDWARDS, assistant research director of the Aluminum Co. of America, has received the Pittsburgh Award of the A.C.S.

# Structure and Properties of High Polymers\*

## Interpretation of their Mechanical Behaviour

by DR. H. MARK

*Professor of Organic Chemistry, Polytechnic Institute, Brooklyn*

THE following structural features seem to be important for the thermal and mechanical behaviour of high polymers:

(1) *The average degree of polymerisation.* This can be best determined by osmotic or ultracentrifuge measurements or by light-scattering. Viscosity data can only be used if the two characteristic constants of the equation: Intrinsic viscosity =  $K_p a$  (where  $P$  = polymerisation degree, and  $K, a$  = characteristic constants) have been determined by comparative viscometric and osmotic or chemical measurements. Only in such instances, where  $a$  is in the neighbourhood of unity, can the Staudinger rule be applied; in all other cases it leads to erroneous results. It seems that a certain minimum average  $P$  is necessary for obtaining satisfactory mechanical performance of a high polymer material.

(2) *The distribution curve of molecular size.* This function can be obtained by fractionating the polymer under consideration and by investigating its fractions according to (1). All natural and synthetic polymers show more or less wide distribution curves. In general degraded (and purified) natural products, such as cellulose or its derivatives, exhibit somewhat sharper distribution curves than synthetic polymers or copolymers, such as vinyl derivatives or vinyl-butadiene combinations. It seems that a comparatively small fraction (between 5 and 15 per cent. by weight) of constituents having a  $P$  near or below 150 has a very adverse effect on the mechanical and thermal properties of the material. If it is desired to produce samples of highest quality it appears to be recommendable to remove such low-molecular-weight constituents very carefully.

(3) *The intermolecular forces between the chain molecules.* These depend on the chemical nature of the monomer or monomers, and on their arrangement in the chains. The nature and magnitude of these forces can be estimated from the thermal and mechanical behaviour of the material under various stresses at different temperatures. The total average mutual attraction between the chain molecules as well as the existence of very strong local bonds (so called cross-links) is of importance. Strong over-all mutual attraction through hydrogen bridges or strong polar forces leads to typical fibres such as nylon, cellulose, cellu-

lose esters, Saran, etc. Such materials exhibit under all conditions a certain degree of crystallinity; their properties are determined by the relative amount of the crystallised and disordered regions, and by the size and orientation of the crystallites. Moderate overall attraction between the chain molecules leads to plastic materials, which—at sufficiently high temperature—exhibit viscous or quasi-viscous flow (behaviour above the brittle point) and show the characteristics of a glass at lower temperatures (below the brittle point). Polystyrene, polyvinyl chloride acetate copolymers, and polyacryl esters are of this type. Such samples consist only unusually of disordered regions and show little if any crystallisation. Weak over-all attraction, together with strictly localised strong cross-links, leads to typical rubbers. Such materials are amorphous (or disordered) in the unstretched state, but show definite crystallisation under the influence of an external stress. However, above a certain temperature (transition point), the crystallised areas are stable only in the presence of a certain external stress. As soon as this force ceases to act, the crystals melt and the material contracts; it shows rubber elasticity. Below this temperature, however, it remains crystalline and behaves like a tough and rigid material.

(4) *The internal flexibility of the chain molecules.* This also depends on the chemical nature of the material, particularly on whether there are any double or triple bonds left in the chains, on how many and how large substituents are attached to the main chain, and on whether one has chains which are mainly straight or have a certain degree of branching. It seems that high internal flexibility makes the material slow in respect to its response and produces the phenomenon of creep and growth.

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Only seventeen gas cylinders out of the many thousands circulating in the United States were found to be faulty during the whole of last year, stated the Chief Inspector of the Bureau of Explosives at the annual meeting of the Compressed Gas Association in New York recently. Leaking gas caused three fires, but all were occasioned by carelessness; there were no injuries or fatalities, and the only damage done was a fire loss amounting to \$400. He added that there had been a nine-fold increase in the transport of poison gas.

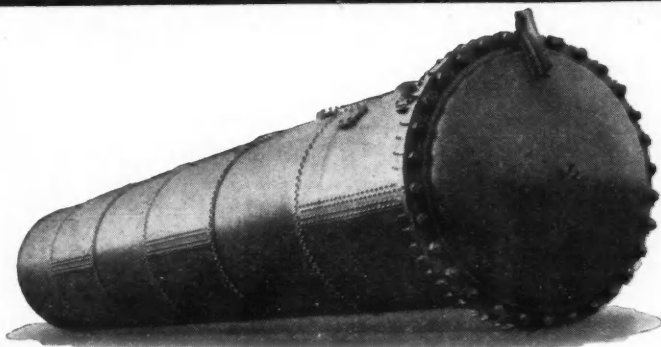
\* From a lecture delivered to the American Society of European Chemists and Pharmacists (A.S.E.C.)



# Metallurgical Section

Published the first Saturday in the month

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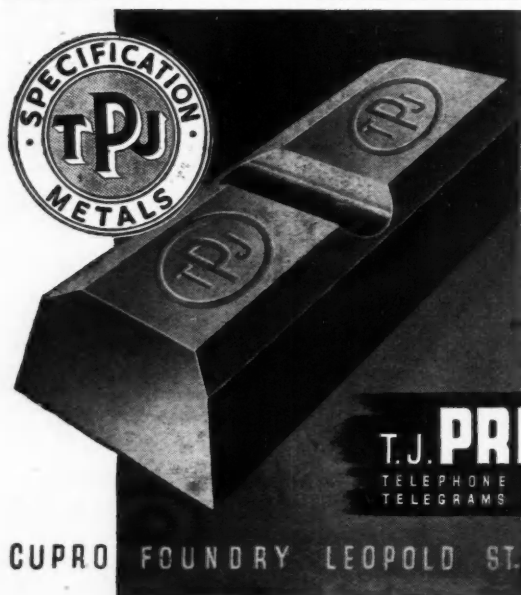
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# Metallurgical Section

June 3, 1944

## The Spanish Metallurgical Industries

### III.—Non-Ferrous Metals

*(From a Special Correspondent)**(Continued from THE CHEMICAL AGE, March 4, 1944, p. 234)*

THE principal non-ferrous metals produced in Spain are copper, lead, and mercury. Years ago there was also a considerable output of silver, together with a certain amount of gold; but these had greatly declined up to the time of the Civil War. Lately, however, some attempt is being made to restore the Rio Tinto and Tharsis gold and silver industry, and some notes thereon, based on a recent article by Francisco Arniches (Director of the Spanish Customs Office), in *Ion*, are given below.

#### Copper

There has been little or no publication of official statistics of Spanish metal production in recent years, so that the latest figures here given can be only approximate estimates. Mine production of copper in 1938 was about 30,000 tons, while that of smelter was 11,000 and for the latter in 1939 the figure was about 7300 tons. For 1940 the estimate was only 4400 metric tons, of which 3000 tons was blister and the remainder black copper. This considerable decline in output was attributed to loss of markets by extension of the war, inability to secure ocean transport, lack of mining explosives and coal, and general disorganisation within the country. Production of ore by the British-owned Rio Tinto Co., Ltd.—the principal copper-producing company in Spain—has not been stated for 1940, but it amounted to 820,000 tons in 1939 and 1,283,000 tons in 1938. The whole of the 1939 output was smelted in Spain. Before the war Germany was the principal market for Spanish copper; but although up to the end of December, 1940, Germany had been able to secure large supplies of mercury from Spain and, of course, also from Italy, she was apparently unable to secure much Spanish copper or lead. In any case the output was too small to be worth troubling about, at least in the case of copper. For lead the position appears to be a little better.

#### Lead

Production of this metal declined from 46,600 tons in 1936 to 27,000 tons in 1939.

For 1940 estimates ranging from 31,700 to 56,500 tons have been given. Here, again, there is little information available. The sale of lead is under the control of the Government, and stocks in 1941 were reported to be negligible. In June, 1940, it was reported that an output of 2450 metric tons per month had been achieved, Italy and Germany being the chief purchasers. Very few if any of the old mines are being reopened owing to the low price paid by the Government for its own purchases. So far as lead and copper are concerned it would seem that the "self-sufficiency" policy is receiving only lukewarm support.

#### Mercury

Spain and Italy have been the world's chief exporters of mercury, and in 1936 Spain exported to the U.S.A. no less than 775,000 lb. which dropped to 3000 lb. in 1940. While Italy was still in the war the Axis countries were well supplied with this metal. Italy's annual output was not much below 70,000 flasks (of 76 lb. each, or 29 flasks to the metric ton), while the Spanish figures are said to have been larger, and the view was expressed in 1941 that they could be considerably increased. Between August 1 and December 31, 1940, at least 42,000 flasks went to Germany and about 20,000 to Japan, largely for use in synthetic rubber plants. The statement that the Spanish output exceeds or has exceeded that of Italy appears to require confirmation in view of the fact that the yearly average for Spain during the period 1932-6 was not more than 31,000 flasks, and for the preceding quinquennial period 49,400 flasks. The chief Spanish mines are at Almadén.

#### Gold and Silver

Spanish production of silver in 1939 was no more than 500,000 oz. Troy, as compared with 5,360,000 oz. in 1912 and just over 1,000,000 oz. in 1876—the first year in which the Spanish silver industry published a report. That of gold in 1939 was about 2000 oz., the same as 1938. Señor Arniches appears to regard recent attempts to increase

the yield of both gold and silver as a further contribution to Spanish autarky; but it is a little difficult to forecast what is going to be any particular country's demand for gold and silver in the post-war years, either for industrial or currency purposes; and it is rather more difficult to see how Spain proposes to pursue an exclusively autarkical policy after the war, in regard to essential metals.

When the mining developments at Tharsis and Rio Tinto in the province of Huelva were begun several years ago with the working of the vast pyritic deposits, the overburdens were piled up in huge mounds (*monteras*) and work was mainly concentrated on the underlying cupro-ferrous strata. The overburden, through natural oxidation of the pyrites, was converted largely into iron oxides. In Tharsis the gold content of these mounds was 3-5 gr. and of silver 40-150 gr. per ton; and somewhat less in Rio Tinto. In 1940 small quantities of gold and silver concentrates were exported to U.S.A. and Scotland. In February, 1941, the Ministry of Industry and Commerce decreed that Spanish pyrites should so far as possible be utilised at home for production of sulphur and sulphuric acid, and more particularly

that the gold and silver content, and also copper where present, should be recovered in the national interest. Señor Arniches appears to be a little uncertain as to the extent to which this decree has been implemented, and no details are given as to the recovery of sulphur and copper. In regard to gold and silver the author contents himself with a brief description of the cyaniding methods used in Spain, together with a few figures giving weights of gold and silver ingots obtained in New York and London from Spanish concentrates, apparently in 1940.

There appears to be a slight difference in detail in the methods used in Tharsis as compared with Rio Tinto, but generally the process is the usual one of wet grinding or crushing of the ore, treatment with lime followed by cyaniding with a weak solution of sodium cyanide, stirring, filtering, etc. The concentrates obtained in Tharsis are considerably richer than those of Rio Tinto. In the former the gold content is 2-6 per cent., silver 30-40 per cent., whereas in the latter the content of gold is 500 gr. and of silver 1900 gr. per ton. No details are given of quantities worked.

## Corrosion of Chemical Plant

### Results of Recent Russian Investigation

**A**T the Second Russian Conference on Corrosion of Metals, T. A. Adshemyan reported on the corrosion work of the State Institute of Applied Chemistry in the years 1938-1940. The investigation was concerned with selection of materials for apparatus used in the more important branches of the chemical industry of Russia, and the results are arranged according to the corrosive agent.

#### Metal Halides

Calcium chloride solutions up to saturation below 80° C. are not corrosive towards a wide range of metals. At 150-170° C. mild steel loses to concentrated CaCl<sub>2</sub> solutions about 1 g./sq.m./hour, and copper and aluminium bronze are corroded nearly as badly, while zinc is leached out of brass. Silver and chromium steels (e.g., C 0.2, Mn 0.8, Cr 14, Ni 0.5, P traces, Fe the rest; and C 0.1, Mn 0.5, Cr 17, Ni 0.2, Si 0.5, P and S traces, Fe the rest) also are corroded. Chrome-nickel steels (of the 18/8 type) show a little pitting, but are quite suitable. The effects of magnesium chloride are closely similar to those of calcium chloride.

The filtrate from sodium bicarbonate in soda manufacture, which contains sodium chloride, ammonium chloride, ammonium sulphate, and ammonium carbonate, is not corrosive, but it becomes acid in the process of evaporation. It then corrodes all

technical metals except chrome-nickel, and especially chrome-nickel-molybdenum steels. The vapour of this liquid is so corrosive that metals must be protected from it by a non-metallic material.

Iron can be used in solutions of chlorides of sodium, potassium, and magnesium if it is cathodically polarised. The current density required is of the order of 0.1-0.2 amp./sq.m. at 20° C. in a stagnant solution, but is raised to 1.5-2.5 amp./sq.m. when the solution is either well stirred or heated to 100° C.

#### Sulphur Compounds

Evaporation of sodium sulphide solutions to produce solid sodium sulphide cannot be carried out in grey iron, but is possible in chrome iron (C 2, Cr 37, Fe the remainder) and in chrome-nickel steels, although even these materials lose about 1 g./sq.m./hour at about 170° C.

Dissolution of SO<sub>2</sub> in sodium carbonate solutions to make sodium sulphite can be carried out, not only in lead vessels, but also in fireclay, wood, rubber, or bitumen-coated vessels. When a solution of SO<sub>2</sub> in sodium chloride solution absorbs ammonia (in the manufacture of Na<sub>2</sub>SO<sub>3</sub> and NH<sub>4</sub>Cl), the acid part of the reaction can be performed in an alloy of the type Cr 20, Ni 25, Mo 2.5, Si 3.5, Cu 1.5, C 0.07, Fe the rest, or in a

chrome-nickel-molybdenum steel (e.g., Cr 17, Ni 8, Mo 3.6). For the alkaline part of the reaction grey iron is as good as chromium steel; lead and aluminium bronze are even more resistant. Wood is rapidly decomposed.

### Fluorine Compounds

Hydrogen fluoride (40 per cent.) corrodes chrome steels and chrome iron (see above) about five times as seriously as mild steel; even chrome-nickel steels are less corrosion-resistant than mild steel; neither of these materials can be used for storing the acid. Monel metal shows the least corrosion, nickel and copper are good, and lead is satisfactory. Hydrogen fluoride (100 per cent.) at  $-15^{\circ}$  and  $+15^{\circ}$  C. can be stored in mild steel, copper or Monel metal, which give weight losses of about 0.1 g./sq.m./hour. Grey iron, chromium steels, chrome-nickel steels, nickel, and brass lose from about three to nine times as much. Lead is even more easily corroded. At  $500^{\circ}$  C. there is no difference in the corrosion-resistance of mild steel, Monel metal, nickel, copper, and brass towards moist HF vapour.

The synthesis of difluorodichloromethane (for refrigerators) from carbon tetrachloride and hydrogen fluoride at  $250^{\circ}$  C. is best carried out in Monel metal, although the corrosion of mild steel (1 g./sq.m./hour) is not prohibitive. Lead, grey iron, and brass are unstable.

Antimony trifluoride solutions can be evaporated to  $120^{\circ}$  C. in lead, which gives better results than either Cr-Ni-Mo-steel or Monel metal and is greatly superior to chrome steel, chrome-nickel steels, or nickel. But at  $140^{\circ}$  C. lead is rapidly corroded, and Monel and Cr-Ni-Mo-steel then head the list.

Evaporators for ammonium fluoride should be of nickel; Monel metal is also good except that it shows a "waterline corrosion." Mild steel is less resistant, and chrome steels are even worse. Copper shows a strong "waterline corrosion." Solutions of  $\text{H}_2\text{SiF}_6$  at  $60^{\circ}$  C. are very corrosive except towards copper and lead, although lead shows a "waterline corrosion."

### Miscellaneous

Salt solutions containing free chlorine, bromine, or iodine corrode all metals strongly except silicon-iron (Si 14-15, C 0.5-0.8) and, in some instances, Cr-Ni-Mo-steels. Acid-resistant silicates and plastics filled with asbestos are the most dependable materials.

Hydrogen peroxide can be distilled from acid ammonium persulphate solutions through tubes of chrome steel or chrome-nickel steel. These steels do not accelerate the decomposition of hydrogen peroxide if they are definitely in the passive state. To ensure success the peroxide concentration must be sufficiently high.

## Tin Research Progress Speculum Plating

FOR security reasons only brief descriptions of the nature and scope of the Tin Research Institute's recent technical advances are given in the latest issue of the Institute's review, *Tin and Its Uses* (No. 15, March, 1944). Perhaps the most striking development reported in it is a new method of tinning cast-iron which, it is stated, is less complicated than some of the processes hitherto in use. The success of the process is evident from the photographs which illustrate the article. Striking progress has also been made in the manufacture and casting of bronze, and it is suggested that after the war new high-tin bronzes of extraordinary strength, coupled with toughness and ductility, will be available to meet long-felt needs throughout the engineering world.

Another new development ripe for extensive commercial application as soon as tin becomes plentiful is speculum plating. Speculum is an alloy of tin and copper that was used in ancient times for mirrors; its use for the mirrors of reflecting telescopes made possible the astronomical discoveries of Herschel and his contemporaries. Speculum can now be electroplated on to other metals, e.g., steel. It is being used for the production of non-tarnishing spoons and forks, and the combination of the attractive appearance of speculum plating with the hardness and strength of the steel base promises to precipitate a revolution in post-war tableware.

This issue also includes an account of the proposed activities of the Tin Research Institute in post-war years. *Tin and Its Uses* may be obtained from Tin Research Institute, Fraser Road, Greenford, Middlesex.

## INTERNATIONAL NICKEL'S OUTPUT

Production of nickel by the International Nickel Co. of Canada, Ltd., last year approximated to the record output of 1942, notwithstanding the fact that during half of 1943 the output from the mines dropped 10 per cent. below their increased capacities. The decline was due to labour shortage as well as to the necessary employment of many inexperienced workers. This statement was made by Mr. R. C. Stanley, president and chairman of the company, addressing the annual meeting in Toronto on April 26. Prices of nickel remained at levels prevailing for many years. Production costs had risen, said Mr. Stanley, and were still rising. Moreover in expanding operations a heavy financial burden had been assumed. Copper deliveries in all forms, including copper in "Monel" matte and copper refined for others, amounted to 316,000,000 lb., compared with 336,000,000 lb. in 1942.

## Parliamentary Topics

### Iron Ore to Germany

IN the House of Commons recently, Sir A. Southby asked the Parliamentary Secretary to the Ministry of Economic Warfare to what extent iron ore was now being exported from Sweden to Germany. The Parliamentary Secretary to the Ministry of Economic Warfare replied that the Swedish Government had made arrangements to limit exports of iron ore to Germany during 1944 to a maximum of 7,000,000 tons as compared with over 10,000,000 tons in 1943. In addition there were small exports to other Axis countries.

Sir A. Southby then asked what proportion of the Swedish exports of iron ore for Germany came from Grängesberg Mine and whether that mine was not owned by Wallenbergs, who came to this country and conducted negotiations here. Mr. Foot said he would not like to accept the accuracy of that statement without notice.

### Spanish Exports

Sir William Davison asked the Parliamentary Secretary to the Ministry of Economic Warfare whether, in recent negotiations with the Spanish Government, attention was drawn to the controlling interest acquired by Germany in a large number of Spanish companies producing iron, steel, nitrogen and other war essentials; and what steps had been taken to prevent Germany from continuing to be supplied by Spain with these war essentials. The Parliamentary Secretary to the Ministry of Economic Warfare, Mr. Dingle Foot, said that while it was true that he had received considerable evidence of German infiltration into Spanish industry, the acquisition by foreign companies of controlling interests in Spanish companies was prohibited under Spanish law. There were no exports of nitrogen in 1943, and exports of iron and steel (as distinct from iron ore) from Spain to Germany were negligible; indeed, Spain imported iron and steel from Germany and German-occupied territories.

DR. ANDREW McCANCE, F.R.S., has been appointed deputy-chairman and joint managing director of Colvilles, Ltd., having been a member of the board since 1930. Dr. McCance is one of the leading iron and steel metallurgists of the country; in 1940 he was awarded the Bessemer Gold Medal of the Iron and Steel Institute, and only last month he was appointed chairman of the new British Iron and Steel Research Institute. He spent nine years with William Beardmore & Co. before beginning his association with the Colville group (in 1919) as managing director of the Clyde Alloy Steel Co., Ltd.

## Wrought Steels

### Amended British Standard

AN amendment slip has recently been issued to B.S. 970 which incorporates modifications to Steels EN 24, EN 33, EN 34 and EN 110. The alteration to EN 24 relates to the deletion of the note permitting the omission of molybdenum and the addition of a footnote to the effect that the relaxation of the Izod test does not apply to material under condition Z. The alteration to EN 33 relates to the heat-treatment to be given to the test pieces. The alteration to EN 24 modifies the chemical composition, while the alteration to EN 110 relates to mechanical properties. In view of the alteration to EN 110 it has been necessary to amend the requirements in the sanctions in B.S. 970b, and this amendment is issued as P.D. 228. Copies of this amendment slip may be obtained from the British Standards Institution.

Ammonia production in the United States is being curtailed to meet changing explosives needs, and also because there is not the equipment to convert into fertilisers the ammonia that would be surplus if production remained at present levels. The need to transfer skilled workers from ammonia manufacture to high-octane fuel operations is another factor behind the new trend, which arises primarily from large-scale production of a new type of explosive.

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# The Association of Scientific Workers

## Presidential Address

THE Association of Scientific Workers held their 27th annual council meeting at Beaver Hall, London, at Whitsun, 225 delegates attending. The president, Professor P. M. S. Blackett, F.R.S., attended the opening session and delivered his presidential address. He said it was reasonable to suppose, without undue confidence, that in a very short time the European war would be successfully won, and that the weapons and devices which so many members of the A.Sc.W. had helped to fashion would have done their job in the field. "Your part of that job and mine is largely over," he said, "and it is up to the fighting men to make full use of these weapons. It is their courage and determination which will settle the issue. But even when the European war is over, we still have a considerable fight ahead of us in the Pacific. This will keep our minds much on war problems for some time to come, and it is just the conditions of the Pacific war—the terrain, climate and geographical factors—which can only be solved by the close collaboration of the engineer, the scientist and the fighting man."

Professor Blackett referred to the growth of the Association—from 2000 members to 15,000 in three years. During the past year some £36,000 had been won for 1000 members by action in the industrial field. He suggested that that was a good dividend for their subscriptions. After the pure trade union work the most important part of the Association's activities was in connection with the future of science, and its relation to the industry of this country. "Once you embark upon policy for post-war science," added the president, "one is directly and immediately led into politics in the broadest sense. Good and essential as the development of science is, it must be remembered that no plan will survive intact in an economic crisis. Science alone cannot cure economic ills. If things go wrong, plans for developing science will go wrong, and money for research will dry up." Referring to the Government's White Paper on Employment Policy, Professor Blackett said one was faced with the fact that we are too ignorant to judge it—"one does not know whether it is good, bad or indifferent: one is torn between the fear of looking a gift horse in the mouth, or buying a pig in a poke." It was far too early to judge the report on full—or should he say *nearly* full?—employment, but he did feel that this was the key issue which

Professor  
P. M. S.  
Blackett,  
F.R.S.



would govern their status as scientists, their salaries, etc. He hoped that the Association would be able to strengthen its membership in the universities, research institutes, etc. Even if university staffs were in a comfortable position, which was often not the case, the contact with other scientists that the A.Sc.W. provided was very valuable and important. Speaking from his own experience of university life after the Great War, he said it would have been extraordinarily valuable in his youth to have had such contacts as had since been built up.

## An Important Resolution

The chairman of the meeting, Mr. W. Oliver, had a formidable task in keeping the meeting up to schedule on an agenda which included about 90 resolutions, many of them with several and lengthy amendments. One of the most important resolutions, put forward by the Executive Committee, dealt with post-war policy for science. After emphasising the way in which the needs of war have compelled a much fuller use of science, not only in weapon production but also in the securing of more and better food and the development of revolutionary methods of healing, the resolution demanded that science must play a still greater part in combating want and disease after the war. "We do not believe that, when the immediate shock of war has receded, the world need be in any material way poorer than it was before. On the contrary, science in the service of the people can create for them wealth and prosperity hitherto unknown," declared the motion. Science must increase world production of food so that all men may, at the least, enjoy diets adequate for health; technical advances in industry must provide agricultural and other machinery, fertilisers, housing, clothing, fuel, transport and many other things necessary for the increase of living standards throughout the world. Special assistance would be needed

in overcrowded and undeveloped areas like India and China, and in colonial territories. Production and distribution must be controlled in accordance with scientific estimates of man's requirements, a programme which could be carried out by the collaboration of democratic nations.

The perversion and frustration of science, continued this motion, between the wars as a result of the control of production in many lands by powerful vested interests could not be forgotten. In seeking to achieve the full use of science for the benefit of the people, powerful opposition must be expected, but scientists would have a powerful ally in the broad progressive movement of humanity, of which, in Britain, the organised trade union movement was the decisive section. They must develop in the trade unions an appreciation of the power of science and its importance for social development.

This resolution, which was passed unanimously, has been followed up by the circulation to all branches of a memorandum on post-war development of scientific resources, prepared by the Social Relations Committee. A national conference may later be held to derive concrete proposals from the memorandum, which in the meantime is to be expanded into a 50,000-word book.

#### Technical Education

Technical education came in for a great deal of attention. The meeting urged that it should be rapidly expanded. The establishment in each district of Advisory Councils to ensure that every person had full information available when choosing a career was advocated.

The meeting agreed that part-time study should be encouraged by time off with pay for study, the maximum hours worked (i.e., work plus study in firm's time) being limited to 48 hours a week, and by increases in pay for examinations passed. Where attendance at a technical college was impracticable, training schemes should be arranged in the works. A speaker mentioned that such a scheme was operated by I.C.I. Plastics. Young workers studying for Inter.B.Sc. were given Saturday mornings off, and those taking Final B.Sc. had, in addition, Friday afternoons.

Another resolution asked that university status should be given to technical education, as a first step towards making the chemical and other essential industries a really attractive career for the younger generation. The motion, although it was adopted, was not without its opponents. Dr. M. McCaig, a Manchester University representative, for instance, argued that this would be a retrograde step and would have the effect of turning technical colleges into second-rate universities. The two types of training had different purposes, and

technical colleges should stand on their own feet and in their own right.

An emergency resolution was passed welcoming the Budget Speech proposals of the Chancellor of the Exchequer for tax relief for expenditure on research. As such tax rebate was ultimately a charge on public funds, the meeting held that there should be some measure of public control of tax relief; the amounts of tax relief allowed should be subject to public scrutiny, while lines of research should conform to a national plan. Financial assistance to private industry in this respect should be accompanied by increased Government research grants.

The meeting demanded the setting up of a Royal Commission to investigate the operation of the Patent Laws. One speaker explained that the departmental committee (see THE CHEMICAL AGE, May 6, p. 433) now studying Patent questions was bound only to report to the President of the Board of Trade, and there was no guarantee that the report would be made public.

The action of the Executive Committee during the past year in working for the closest co-operation with the British Association of Chemists was approved, and the meeting urged that these efforts should be continued.

A suggestion by the Porton Branch that there might be an extension of the Factory Acts so that Government inspectors should be required to inspect all laboratory premises, which should conform with the Factory Act provisions in so far as health and safety were concerned, met with considerable criticism. Several speakers argued that scientists were considered competent to judge the risks attending their experimentation, and were not in the same position as unskilled workers. Another point was that the application of Factory Acts to laboratories would hinder scientific research. The meeting did not vote on this motion, which was referred to the Executive Committee for further consideration.

#### Executive Committee

The following were elected to the Committee: MR. R. S. BICKLE, DR. A. H. BUNTING, MR. J. T. H. CHRISPE, MRS. P. H. CLARKE, MR. F. A. CRONE, MR. R. G. FORRESTER, DR. D. MCCLEAN, MR. N. W. PIRIE, MR. J. SMITH. Area representatives on the committee are as follows: MR. L. H. B. KNOX (London), MR. A. H. SIMCOX (North-West), MR. C. T. WILSHAW (West Midlands), MR. J. P. SAVILLE (South Wales), MR. H. J. DICKINSON (East Midlands), DR. J. L. B. HOOPER (South-West), MR. W. J. A. PAYNE (Cambridge), MR. J. FLEMING (Scotland), MR. G. K. LANE (Southern), DR. N. LEVY (Northern). There are thus seven chemists and one metallurgist on the Executive.



## Personal Notes

MR. P. R. MARSHALL has been awarded the Savile-Shaw Medal, of the Newcastle section of the Society of Chemical Industry, for researches on the carburising of steel.

MR. E. S. DUMONT has been appointed chairman and managing director of the Kolok Manufacturing Co., Ltd., to fill the vacancy caused by the death of Mr. F. M. O'Brien, the former chairman.

SIR HENRY DALE, P.R.S., is the first recipient of the gold medal recently founded by the Indian Association for the Cultivation of Science, in memory of Dr. B. C. Law.

MR. L. G. GABRIEL, F.R.I.C., has been elected chairman of the Road and Building Materials group of the S.C.I. for 1944-5. MR. A. V. HUSSEY, F.R.I.C., M.I.Chem.E., is vice-chairman, and DR. F. H. GARNER, F.R.I.C., hon. treasurer.

MR. JAMES LAWRIE has been awarded the sixth-year chemistry prize at the Heriot-Watt College, Edinburgh. In making the award, Principal Cameron Small announced that during the past year an increased amount of work in chemistry had been recorded.

SIR ROBERT ROBINSON, in his capacity as a member of the Colonial Products Research Council, is to visit the West Indies this summer to discuss with local research organisations some of their problems, more especially those relating to the petroleum and sugar industries.

The following seven out of 39 candidates have been elected to the Council of the Pharmaceutical Society of Great Britain: MR. A. R. MELHUISH, past president; MR. L. M. PARRY, past president; MR. G. R. KNOX MAWER; MR. E. A. BROCKLEHURST; MR. THOMAS HESELTINE; MR. F. G. WELLS; and MR. J. C. YOUNG.

MAJOR STANLEY M. MOHR, who has been chairman of the British Plastics Federation for the past five years, retired from office at the recent annual meeting. In recognition of his work for the industry, the Executive Committee of the Federation have presented him with an inscribed silver salver. Major Mohr is succeeded by MR. H. W. GRAEFFER-THOMAS.

MRS. EUPHEMIA LINDSAY and Miss SHEILA DALGLEISH, process workers in a nitrocellulose press house at a Scottish explosives factory, are cited in the *London Gazette* as having been awarded the British Empire Medal. When fire broke out in the factory they obtained a hose and played water on it until the arrival of the firemen. Their prompt action prevented the fire from reaching bags of powder and averted what might have been a serious explosion.

FLIGHT-LIEUTENANT PERCY R. LEVY, R.A.F., has been elected to the board of George Cohen, Sons & Co., Ltd. The younger son of the company's vice-chairman, Mr. George Levy, he is an engineering graduate of Cambridge, and served his apprenticeship at the works of K. & L. Steelfounders and Engineers, Ltd.

Three well-known departmental heads have been appointed to the board of directors of Walworth, Ltd. They are MR. G. J. PILBEAM, sales manager, who has been in the employ of the company since 1914; MR. A. DEWEY, buyer, who started with the company in 1911; and MR. E. PALMER, secretary and accountant, who joined the company 16 years ago.

MR. W. L. GOVIER was elected president of the Birmingham Metallurgical Society at the annual meeting last week. Other officers elected were: Vice-presidents, MR. L. C. BATCHELOR, MR. N. F. FLETCHER, DR. T. WRIGHT and DR. J. W. JENKIN; hon. treasurer, MR. A. C. CRAIG; members of council, MR. W. E. BALLARD, MR. R. F. COTTON, MR. G. H. M. HOLDEN and MR. A. R. WAINWRIGHT. The secretary is MR. F. G. TUSTIN.

The following officers were elected at the annual meeting of the Newcastle section, Society of Chemical Industry: Chairman, DR. P. L. ROBINSON; vice-chairman, DR. A. E. J. VICKERS; hon. treasurer, MR. B. P. HILL (resident in 1943/44); hon. secretary, MR. E. M. MYERS; hon. asst. secretary, MR. H. E. BLAYDEN; hon. recorder, MR. J. MILLS; committee, DR. M. P. APPLEBEY, MR. W. P. CAREY, PROFESSOR G. R. CLEMO, F.R.S., MR. J. W. CRAGGS, DR. A. A. HALL, MR. H. HELLEWELL, MR. R. H. HOUSTOUN, MR. R. H. KERLOGUE, MR. E. W. MUDDIMAN, and DR. G. E. STEPHENSON.

The annual meeting of the Association of British Insecticide Manufacturers, held on May 24, elected the following officers and executive committee: Chairman, MR. H. J. JONES (Hemingway & Co., Ltd.); vice-chairman, MR. T. AINSLIE ROBERTSON (Plant Protection, Ltd.); hon. treasurer, MR. R. V. CRAVEN (W. J. Craven & Co., Ltd.); hon. auditor, MR. R. A. BLAIR (Burt Boulton & Haywood, Ltd.). Executive committee, MR. A. BERK (F. W. Berk & Co., Ltd.); MR. R. V. CRAVEN (W. J. Craven & Co., Ltd.); DR. E. HOLMES (Imperial Chemical Industries, Ltd.); MR. H. I. KINGSTON (Geo. Monro, Ltd.); MR. J. S. MITCHELL (Murphy Chemical Co., Ltd.); DR. T. F. WEST (Stafford Allen & Sons, Ltd.). MR. A. J. HOLDEN, B.Sc., F.I.C., and MR. W. A. WILLIAMS, B.Sc., continue to act as assistant secretaries of the Association in the continued absence of Mr. Davidson Pratt on war service.

## General News

The committee inquiring into the operation of the Patents Act on behalf of the Board of Trade invites those who wish to submit suggestions or give evidence to communicate with the Joint Secretaries to the Patents Committee, 1944, the Patent Office, 25 Southampton Buildings, London, W.C.2 (see *THE CHEMICAL AGE*, May 6, p. 433).

**The Control of Iron and Steel**, (No. 34) Order, 1944 (S.R. & O. 1944, No. 565, price 2d.), amends the Control of Iron and Steel (No. 33) Order by the revision of the Fifth Schedule (which contains basic maximum prices) and of certain of the Related Price Schedules. In addition, prices are instituted for the first time for tube steel billets and pipe and tube joints. The Order came into force on May 19.

A claim for standard rates of pay was recently lodged by members of the Association of Scientific Workers employed as chemists, metallurgists and laboratory assistants at two works of the Clyde Alloy Steel Co., Ltd., Motherwell. It came before the National Arbitration Tribunal on May 12, and was rejected. Details of the claim are to be found in *National Arbitration Tribunal Award No. 556*, H.M.S.O., 1d.

**Papers of interest** in the Smithsonian report for 1942, which has recently been published, include "Chemical Properties of Viruses" (No. 3716), by W. M. Stanley; and "Industrial Development of Synthetic Vitamins" (No. 3717), by R. T. Major (Merck & Co., Inc.). The latter is reprinted from *Chem. Eng. News*, and incorporates some remarkable diagrams illustrating the fall in the cost of vitamins in the period 1935-42.

**Three out of five men** who appeared at Leeds Assizes a fortnight ago charged with receiving metal stolen from Marston Excelsior, Ltd., Maidenhead, Sheffield (a branch of I.C.I., Ltd.), were sentenced to terms of imprisonment. A sixth man, a clerk employed by the company, who pleaded guilty to several charges of stealing the metal involved—duralumin and brass valued at over £1100—was sentenced to three years' penal servitude.

A brochure, entitled *Metallography of Some Aluminium Alloys*, by Mr. M. D. Smith, has been published by the British Non-Ferrous Metals Research Association. This research report (No. 635) is on public sale, price 2s. It deals with the structure of various alloys in the cast condition and after quenching, the alloys investigated including: DTD 424, NA 226, L5, L8, L11, L39, Y alloy, RR 50, RR 53, RR 72B, Aeral A and Alpac gamma. There are 28 photomicrographs.

## From Week to Week

A useful method of minimising the disastrous effect of May frosts upon orchards, which is stated, in a letter to *The Times*, to have been successfully used in Germany before the war, consists in the formation of a heavy white fog by the dripping of acid on lime. Mr. W. F. Jackson, of Ross-on-Wye, writer of the letter, states that he has been unable either to import the necessary outfits or to arrange for their manufacture here, although he avers that they are much less cumbersome than either orchard heaters or smudge pots.

The effect of anti-oxidants on various kinds of edible fat is described by C. H. Lea in *J.S.C.I.*, 63, 2, 55 and 4, 107. With butter fat, pyrogallol, quinol, 1:5-dihydroxynaphthalene, pyrogallol-acetone condensation product, gallic acid and its esters, pyrocatechol and haematoxylin proved most powerful. Ethyl gallate, 1:5-dihydroxynaphthalene and guaiacum resin incorporated in dried pork at concentrations of 0.02-0.1 per cent. have been found useful for retarding the development of "off" flavours due to oxidation of the fat, when the meat is stored in a non-airtight container.

## Foreign News

**Dinitro-ortho-cresol** is being used in Kenya as a contact poison for the control of locusts.

**Synthetic oil plants** at Merseburg, Zeitz and Lutzkendorf were heavily bombed by Fortresses and Liberators of the U.S. Air Force on May 28.

**Canada** last year exported chemicals and allied products to the record value of \$69,200,000, nearly three times the figure for 1939.

**U.S. production of penicillin** last year amounted to 21,092 million Oxford units, estimates the Chemical Bureau of the War Production Board.

**U.S. mercury supplies** in 1943 amounted to 100,000 flasks, about half being imported, the remainder domestic production. Consumption was 53,000 flasks.

**Canadian copper** to the amount of 15,000 tons, reports Reuter, will be shipped to the U.S. in order to ease the strain on U.S. mines for the remainder of this year.

**The Alien Property Custodian** exhibited 10,000 enemy patents and patent applications at the recent American Chemical Society meeting in Cleveland.

**Two new plastics**—Geon 202 and 203—are being made by the Chemical Division of B.F. Goodrich Co. of America. These resins are described as entirely new vinyl chloride-vinylidene chloride polymers.



**Germany's Auer Research Endowment** is offering a prize for the discovery of new outlets for rare earths, thorium, zirconium and similar elements.

**Brazil's** output of tungsten ore increased last year by 19 per cent. over the 1942 figure, 4585 tons of  $WO_3$  being produced. Exports of metals and minerals in 1943 had a total value of \$78,289,485.

**Additional supplies** of iron pyrites having been received, about 15,000 tons of superphosphates, or approximately 50 per cent. of present domestic needs, will probably be manufactured in French Morocco in 1944.

**The Polaroid Corporation**, of Cambridge, Mass., announces that a method of synthesising quinine has been devised by two organic chemists, Robert B. Woodward, of Harvard, and William E. Doering, of Columbia University.

**A plant is to be erected** in Hungary at a cost of over 100,000 pengő for the production of fibre from maize straw and sunflower stalks. Though both these plants are cultivated in Hungary in large quantities, so far no use has been made of their cellulose-containing parts.

**Because of the shortage** of arsenic due to import difficulties, the Brazilian Government has ordered the production and distribution of arsenic to be controlled. Before the war Belgium, the U.S.A., Japan, and Germany were the chief suppliers, but now supplies are available only in restricted quantities from the U.S.A. and the U.K.

**Oil has been found** in Turkey as a result of recent drilling operations carried out in the Ramandag and Adana districts. Giving this information in the House of Commons. Mr. Dingle Foot, of the Ministry of Economic Warfare, said that the finds were not of commercial volume. No oil concessions in Turkey are owned by German companies, he added.

**The leading French chemical** and glass company, Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chaunay, et Cirey, is submitting to its annual general meeting, on June 5, a proposal for an issue of preference shares up to 300 million francs. For 1943 a dividend of 45 francs per 500-franc share is being proposed; this compares with 60.88 francs a year ago when a partial liquidation of reserves took place.

**U.S. synthetic rubber** production is expected to reach 75,000 tons a month in July, as against 50,000 tons in January. In this connection, output of butadiene from alcohol is progressing far quicker than petrol butadiene, partly because it started first, and partly because its production was standardised from the beginning, whereas petrol butadiene was prepared by three different processes.

**A full ore test** has been carried out on a bulk sample of argentiferous galena from Tanganyika. It is proposed to mine this ore commercially and smelt it in this country (*Bull. Imp. Inst.*, 1944, 42, 1, 52).

**Isopropyl acetate** as a substitute for amyl acetate is being considered by several American producers of penicillin. The scarcity of amyl acetate was reported in *THE CHEMICAL AGE* recently (p. 474).

**A recent explosion** in a chemical pump house at the Government-owned Buna-S plant operated by Goodyear in Akron, U.S.A., caused injury to nine people. It was due to butadiene catching fire, but the flames were prevented from spreading to other units.

**Lavoisier's bi-centenary** was celebrated at the joint meeting of the American section of the S.C.I. and the New York section of the A.C.S., held at the Chemists' Club, New York, on March 31. Mr. Lamont du Pont, chairman of the Du Pont Co. and a direct descendant of a pupil of Lavoisier, was one of the speakers.

**Chile** aims to meet half her steel requirements with new domestic production in the Concepcion-Talcahuano area, about 350 miles south of Santiago. It will represent an investment of \$20,000,000, half of which will be spent in the United States on equipment, and the completed plant will employ 1000-1500 men in the manufacture of steel from ores mined at El Tofo.

**The acquisition** of I.F. Laucks, Incorporated, manufacturing chemists and producers of plywood glues, by the Monsanto Chemical Company, is announced. The acquisition includes the Laucks plants at Seattle, Wash., Vancouver, B.C., and Stanbridge, Que., as well as connections in Australia and Sweden. No change in personnel is contemplated and Monsanto plans to operate the company as a separate unit.

**Plastic pellets** are the basis of a modified sand-blasting technique designed for scouring carbon from piston walls and piston-ring grooves of American aero-engines. The material, known as Tenite and prepared by the Tennessee Eastman Corporation, consists of granules similar to the pellets supplied to the moulding industry, only considerably smaller. Further details are given in *Chem. Eng. News*, 1944, 22, p. 378.

**Additional hydro-electric power** for the Shawinigan Water and Power Company's system was provided by the installation during 1943 of two new units, on the St. Maurice River, of 40,000 h.p. and 44,500 h.p. The company also constructed a 60,000-volt line from St. Vincent-de-Paul to connect its transmission system with the generating station of the Montreal Island Power Company on Prairies River.

As a result of a legal decision in the anti-trust action brought by the American Government against the Standard Oil Company of New Jersey two years ago, the Custodian of Alien Property in Washington has now demanded the surrender of certain stocks and shares as well as 675 patents and about 100 patent applications formerly owned by I.G. Farbenindustrie.

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## Forthcoming Events

The next meeting of the Midlands Centre of the **Electrodepositors' Technical Society** will be held on **June 6**, at 6 p.m., at the James Watt Memorial Institute, Birmingham, when Mr. H. C. Clements will open a general discussion on electrical plant with a paper on "The Maintenance of Motor Generators."

The Peter Le Neve Foster Lecture of the **Royal Society of Arts** will be given on **June 7**, at 1.45 p.m., in the society's rooms, John Adam Street, London, W.C.2, by Professor H. W. Florey, F.R.S. His subject will be "Penicillin." Professor A. Fleming will be in the chair.

The **Institution of Factory Managers**, South Eastern (London) branch, will meet at the Bonnington Hotel, Southampton Row, London, W.C.1, on **June 17**, at 2.45 p.m., when a discussion will take place on "Current and Future Problems in Factory Management."

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## Company News

**Goodlass Wall & Lead Industries, Ltd.**, are paying an ordinary dividend of 7 per cent. (same).

**Newton, Chambers & Co., Ltd.**, announce a profit of £230,953 (£205,726) for 1943. Final ordinary dividend is 10 per cent., making 15 per cent. (same).

**Greeff Chemicals Holdings, Ltd.**, report a profit for 1943 of £20,647 (£20,339), and are paying a final ordinary dividend of 5 per cent., plus a bonus of 2 per cent., making 10 per cent. (same).

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## New Companies Registered

**Consolidated Industrial Research Laboratories, Ltd.** (387,744).—Private company. Capital: £300 in 300 shares of £1 each. Manufacturing and research chemists, etc. Subscribers: E. C. Drenon, Mrs. E. A. Drenon, Mrs. E. K. Reeves-Heath. Solicitors: Callingham, Ormond & Maddox, 1 New Square, London, W.C.2.

## Chemical and Allied Stocks and Shares

**C**HEERFUL conditions have ruled in stock markets, with industrials a particularly strong feature, buying being attributed to hopeful views of post-war prospects induced by the Government White Paper on employment policy. On the assumption that after the war there may be a large measure of success in securing full employment of resources and labour power, shares of leading industrial companies have been in request at higher prices, despite the very small yields now ruling on the basis of current dividends.

This reflects hopeful assumptions that in many cases where dividends have been reduced during the past few years, there may be reasonable scope after the war for their return to pre-1940 levels, although it is realised that this may be a gradual process. Smallest movements have been shown in shares of companies with a relatively stable dividend record, and Imperial Chemicals at 39s. 9d. were only slightly better on balance, as were Turner & Newall at 84s. 6d., British Aluminium at 47s. 8d., and Borax Consolidated at 36s. British Oxygen further strengthened to 82s. 9d., Triplex Glass to 39s. 9d., and Wall Paper Manufacturers deferred to 42s. 9d. De La Rue have risen further to 183s. 9d. on hopes of the results showing an increased distribution, although it is realised that a good proportion of profits is likely to be added to reserves, etc. British Industrial Plastics again changed hands around 7s., and Erinoid around 11s. British Glues & Chemicals 4s. ordinary were firm at 9s.

B. Laporte continued more active, with dealings up to 82s. 6d., and elsewhere, Lewis Berger have been dealt in up to 104s. 6d. Associated Cement were better at 66s. 6d. and there was again a good deal of activity in British Plaster Board 5s. ordinary, which were little changed on balance at 32s. 9d. The units of the Distillers Co. were higher at 94s., awaiting the results. United Molasses showed firmness at 33s. 9d.

Textile shares have been prominently active, and although in all cases best prices were not held. Bradford Dyers were 22s. 6d., Fine Cotton Spinners 24s., Calico Printers 16s. 3d., and Bleachers 11s. The market is hopeful that forthcoming results of the last-named company will announce a further payment in respect of preference dividend arrears; in some quarters there is continued talk of the possibility of a capital adjustment scheme to deal with these arrears, and thus bring nearer the position when dividends on the ordinary shares can be resumed.

Iron and steel shares have well maintained recent gains, with Guest Keen 37s. 9d., Dorman Long 27s. 9d., Babcock & Wilcox

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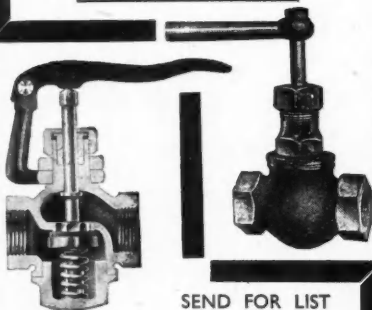
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50s. 6d., and Stewarts & Lloyds 55s. 3d. Conssett Iron 6s. 8d. units at 9s. 3d. continued to reflect market hopes of an increase in the dividend to 10 per cent. Allied Iron-founders showed firmness at 54s. Cellon 5s. ordinary have strengthened to 23s. 6d. Business in Morgan Crucible 5 per cent. preference was recorded up to 24s. 6d., while Greff-Chemicals 5s. ordinary were higher at 8s., and Burt Boulton at 23s. British Drug Houses continued more active around 26s. 3d., buying being based on expectations that after the war a return to 6 per cent. dividends is a reasonable expectation. Owing to the company's very unfavourable E.P.T. standard, net profits have been considerably reduced, despite expansion in trading profits. Rather more attention has been given to Leeds Fireclay ordinary, which changed hands up to 7s. 6d. United Glass Bottle ordinary were 67s. 6d., and Canning Town Glass 5s. ordinary have changed hands around 8s. 6d. Boots Drug were 43s. 9d., Sangers 27s. 1½d., and Timothy Whites 34s. 1½d. Oil shares reflected the buoyant trend of markets; Anglo-Iranian changed hands at over £6 for the first time since 1937.

## British Chemical Prices

### Market Reports

**C**ONTRACT supplies for heavy chemical products are being taken up in satisfactory quantities by consumers and a fair amount of new inquiry in the London market during the past week has resulted in an increase in the number of orders placed. In the soda products section, industrial refined nitrate of soda is being absorbed in good quantities, while a fair trade has been reported in the various grades of sulphide of soda. Steady deliveries of solid and

liquid caustic soda have been effected, and this is also the case with soda ash and bicarbonate of soda. Values are well maintained in Glauber salt and salt cake and buying interest is at a satisfactory level. There is a steady demand for bichromate of soda from priority users, and good quantities of hyposulphite of soda are being taken up. Among the potash chemicals, permanganate is in steady request and prices are well held, and yellow prussiate of potash continues to occupy a strong price position with offers restricted. Fresh inquiry for acid phosphate of potash has been in circulation. In the acid section there is pressure for deliveries of all available grades of sulphuric acid, while values are fully maintained for hydrochloric acid and a fair amount of business is being placed. Tartaric acid and cream of tartar are now under the control of the Ministry of Food under S. R. & O., No. 529, 1944, which came into operation on May 21. The Order provides that tartaric acid and cream of tartar may not be sold (otherwise than by retail) in quantities exceeding 1 lb., except under licence. There is no change in the coal-tar products market this week.

**MANCHESTER.**—Both fresh inquiry and actual new business on the Manchester chemical market during the past week have been strictly moderate, operations having been affected by holiday conditions, which have also been reflected to some extent in the quantities delivered under contract. In some parts of Lancashire, including the Manchester area, these quieter conditions are expected to extend over the greater part of the present week, after which a quick return to normal is anticipated. The by-product trade seems to have been similarly affected. Prices are on a firm basis, with no signs of uneasiness in any section.

**GLASGOW.**—In the Scottish heavy chemical trade there has been a slight improvement during the past week for home business. Export inquiry continues to be rather limited. Prices remain very firm.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

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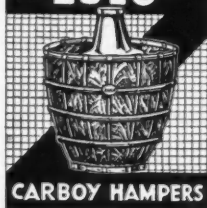


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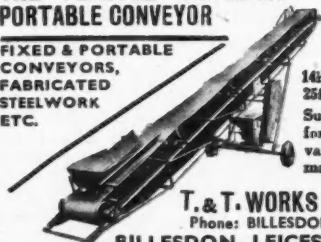
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